STEAM SUPPLYING APPARATUS IN WASHING MACHINE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a washing machine, and more particularly to a steam supplying apparatus in a washing machine in which an air chamber is provided in a tank adapted to supply steam generated therein, in order to guide, to a wash tub, an excessive amount of water supplied into the tank, along with the generated steam.

Description of the Related Art

FIG. 1 is a sectional view illustrating a conventional washing machine. FIG. 2 is a perspective view illustrating an essential configuration of the conventional washing machine.

As shown in FIG. 1, the conventional washing machine includes a cabinet 2 defining the appearance of the washing machine, and carrying a door 1. The conventional washing machine also includes a wash tub including a tub 4 fixedly installed in the cabinet 2, and a drum 6 rotatably installed in the tub 4, and provided with a plurality of water holes 5. The conventional washing machine further includes a drive unit 8 connected with the drum 6 via a rotating shaft 7, and adapted to rotate the drum 6, a water supply unit 10 for supplying wash

water into the wash tub, and a drainage unit 12 for draining wash water from the wash tub.

A detergent supply unit 14 containing detergent therein is arranged at a top portion of the cabinet 2. The water supply unit 10 is connected with the detergent supply unit 14 so that detergent can be supplied from the detergent supply unit 14 into the wash tub, along with wash water.

The tub 4 is connected, at the top thereof, to the top of the cabinet 2 via a spring 16 while being connected, at the bottom thereof, to the bottom of the cabinet 2 via a damper 17 having a damping function.

The above mentioned washing machine may further include a heater 20 adapted to heat wash water supplied into the wash tub. The tub 4 is recessed at a bottom portion thereof to provide a heater chamber 21 for receiving the heater 20 therein.

Now, operation of the conventional washing machine having the above mentioned configuration will be described.

When a wash cycle is begun, wash water is supplied into the tub 4 and drum 6 to a desired level in accordance with the amount of clothes contained in the drum 6, along with detergent. In this state, the drum 6 is rotated in accordance with a drive force from the driving unit 8. As a result, a washing operation is carried out by virtue of a combination of an emulsification function of the detergent with frictional

forces generated between the drum 6 and water flows in the drum 6.

When the heater 20 operates during the washing operation in accordance with an operating mode set by the user, the wash water supplied into the tub 4 and drum 6 is heated. That is, an increase in wash temperature is achieved, so that it is possible to easily remove stains from clothes.

After completion of the wash cycle, the wash water is drained. Fresh wash water is then again supplied into the tub 4 and drum 6. Simultaneously, the drum 6 is rotated to execute a rinse cycle. Finally, the drum 6 is rotated at high speed to execute a spin-dry cycle. Thus, the clothes are completely washed.

In the above mentioned conventional washing machine, wash water is supplied into the tub 4 and drum 6 through top portions thereof, and then permeates into clothes contained in the drum 6 to wet the clothes. On the other hand, the heater 20 is arranged at the bottom of the tub 4. For this reason, in a washing mode using wash water heated by the heater 20, the clothes contained in the drum 6 is wetted by cold wash water at an initial water supply stage without being wetted by hot wash water. As a result, the wetting speed of the clothes is low, so that the efficiency of the heater 20 is degraded.

In the conventional washing machine, the heater chamber 21 should be provided at the tub 4 in the form of a separate

space to install the heater 20. In particular, the heater chamber 21 is provided by downwardly recessing a bottom portion of the tub 4. Due to such a structure, wash water supplied into the tub 4 unnecessarily fills the heater chamber 21, so that there is waste of wash water. Furthermore, detergent is also left in the heater chamber 21, so that there is waste of detergent.

SUMMARY OF THE INVENTION

The present invention has been made in view of the above mentioned problems involved with the related art, and it is an object of the invention to provide a steam supplying apparatus in a washing machine which is capable of supplying steam into a wash tub at the top of the wash tub, along with wash water supplied into the wash tub, thereby achieving an improvement in washing performance.

In accordance with one aspect, the present invention provides a steam supplying apparatus in a washing machine comprising: a tank connected to a water supply unit adapted to supply wash water, the tank being connected at a top portion thereof with a wash tub via a steam supply line; a heater arranged in the tank, and adapted to heat wash water supplied into the tank, thereby generating steam to be supplied into the wash tub; and water level limiting means arranged in the form

of an air-compressible space in the tank above a predetermined water level limit of the tank, the water level limiting means draining, into the steam supply line, an amount of water exceeding the predetermined water level limit after a water level of the tank reaches the predetermined water level limit, using an air pressure generated in the water level limiting means.

The water level limiting means may comprise an air chamber defined in the tank above the predetermined water level limit of the tank, the air chamber being reduced in volume in accordance with an increase in the water level of the tank, thereby causing air existing in the air chamber to be compressed, and an extension passage connected, at one end thereof, to the steam supply line while extending into the tank such that the other end thereof is arranged at the water level limit of the tank, the extension passage allowing the excessive amount of water to be drained from the tank therethrough, along with the steam generated in the tank.

The water supply line connecting the water supply unit and the tank may extend, at an end thereof, into the tank through the top portion of the tank while passing through the air chamber such that the end thereof is arranged at the predetermined water level limit of the tank.

The steam supplying apparatus may further comprise a mesh installed in the tank such that the mesh comes into contact

with a surface of the water in the tank when the water level of the tank reaches the predetermined water level limit.

The mesh may extend from the predetermined water level limit of the tank to an inner top surface of the tank.

The mesh may be provided with a steam hole connected to the steam supply line. The steam hole may be provided at a central portion of a selected one of cell groups each consisting of four adjacent ones of cells defined in the mesh.

The steam hole of the mesh may extend from the predetermined water level of the tank to an inner top surface of the tank to form the extension passage.

The mesh may be provided with a water hole connected to the water supply line. The water hole may be provided at a central portion of a selected one of cell groups each consisting of four adjacent ones of cells defined in the mesh.

The steam supply line may have a nozzle structure at an end thereof connected to the wash tub.

In accordance with another aspect, the present invention provides a steam supplying apparatus in a washing machine comprising: a tank connected to a water supply unit adapted to supply wash water, the tank being connected at a top portion thereof with a wash tub via a steam supply line; a heater arranged in the tank, and adapted to heat wash water supplied into the tank, thereby generating steam to be supplied into the wash tub; water level limiting means arranged in the form of an

air-compressible space in the tank above a predetermined water level limit of the tank, the water level limiting means draining, into the steam supply line, an amount of water exceeding the predetermined water level limit after a water level of the tank reaches the predetermined water level limit, using an air pressure generated in the water level limiting means; and a mesh installed in the tank such that the mesh comes into contact with a surface of the water in the tank when the water level of the tank reaches the predetermined water level limit.

In accordance with still another aspect, the present invention provides a steam supplying apparatus in a washing machine comprising: a tank; a water supply line extending, at one end thereof, into the tank through a top portion of the tank such that the one end thereof is arranged at the predetermined water level limit of the tank, the water supply line being connected, at the other end thereof, to a water supply unit adapted to supply wash water; a steam supply line connected between the top portion of the tank and a wash tub; a heater arranged in the tank, and adapted to heat wash water supplied into the tank, thereby generating steam to be supplied into the wash tub; an air chamber defined in the tank above the predetermined water level limit of the tank, the air chamber being reduced in volume in accordance with an increase in the water level of the tank, thereby causing air existing in the

air chamber to be compressed; an extension passage extending between the steam supply line and the water level limit of the tank, the extension passage allowing the excessive amount of water to be drained from the tank therethrough, along with the steam generated in the tank; and a mesh installed in the tank such that the mesh comes into contact with a surface of the water in the tank when the water level of the tank reaches the predetermined water level limit.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects, and other features and advantages of the present invention will become more apparent after reading the following detailed description when taken in conjunction with the drawings, in which:

FIG. 1 is a sectional view illustrating a conventional washing machine;

FIG. 2 is a perspective view illustrating an essential configuration of the conventional washing machine;

FIG. 3 is a sectional view illustrating a washing machine equipped with a steam supplying apparatus according to an embodiment of the present invention;

FIG. 4 is a perspective view illustrating a part of the washing machine equipped with the steam supplying apparatus according to the embodiment of the present invention;

FIG. 5 is a perspective view illustrating the steam supplying apparatus according to the embodiment of the present invention;

FIG. 6 is a cross-sectional view taken along the line A - A in FIG. 5; and

FIG. 7 is a cross-sectional view taken along the line B - B in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, embodiments of a steam supplying apparatus in a washing machine according to the present invention will be described in detail with reference to the annexed drawings.

Although there may be various embodiments associated with the steam supplying apparatus according to the present invention, the following description will be given in conjunction with the most preferred embodiment. In the following description, the basic configuration of the washing machine will not be given because it is identical to that of conventional washing machines.

FIG. 3 is a sectional view illustrating a washing machine equipped with a steam supplying apparatus according to an embodiment of the present invention. FIG. 4 is a perspective view illustrating a part of the washing machine equipped with the steam supplying apparatus according to the embodiment of

the present invention. FIG. 5 is a perspective view illustrating the steam supplying apparatus according to the embodiment of the present invention. FIG. 6 is a cross-sectional view taken along the line A - A in FIG. 5. FIG. 7 is a cross-sectional view taken along the line B - B in FIG. 5.

The washing machine, which is equipped with the steam supplying apparatus according to the illustrated embodiment of the present invention, includes a cabinet 52 defining the appearance of the washing machine, and carrying a door 51. The washing machine also includes a wash tub including a tub 54 fixedly installed in the cabinet 52, and a drum 56 rotatably installed in the tub 54, and provided with a plurality of water holes 55. The washing machine further includes a drive unit 58 connected with the drum 56 via a rotating shaft 57, and adapted to rotate the drum 56, a water supply unit 60 for supplying wash water into the wash tub, that is, the tub 54 and drum 56, (hereinafter, simply referred to as a "wash tub 54/56") and a drainage unit 62 for draining wash water from the wash tub 54/56. A detergent supply unit 64 containing detergent therein is arranged at a top portion of the cabinet 52. The detergent supply unit 64 is connected to the water supply unit 10 so that it can supply detergent into the wash tub 54/56, along with wash water passing therethrough. The washing machine further includes, as the steam supplying apparatus according to the illustrated embodiment of the present invention, a steam

supplying unit 70 adapted to supply steam into the wash tub 54/56.

The steam supplying unit 70 includes a tank 76 connected to the water supply unit 60 via a water supply line 72 while being connected to the wash tub 54/56 via a steam supply line 74, and a heater 78 arranged in the tank 76, and adapted to heat wash water contained in the tank 76, thereby generating steam to be supplied into the wash tub 54/56.

The water supply line 72 is connected to the water supply unit 60 at a position upstream from the detergent supply unit 64 in order to prevent wash water from passing through the detergent supply unit before entering the tank 76, thereby allowing the tank 76 to receive only the wash water. A water supply valve 71 is installed at the water supply line 72 to open or close the water supply line 72. The water supply valve 71 opens the water supply line 72, simultaneously with supply of wash water into the wash tub 54/56. When the internal pressure of the tank 76 increases to a predetermined level or more, the water supply valve 71 closes the water supply line 72. Also, when a predetermined time has elapsed after the opening of the water supply line 72, the water supply valve 71 may close the water supply line 72. The water supply valve 71 may also close the water supply line 72 when the supply of wash water into the wash tub 54/56 is completed.

Since steam, generated in the tank 76 as the wash water

in the tank 76 is heated, stays at an upper portion of the tank 76, the steam supply line 74 is connected to the top of the tank 76. The steam supply line 74 is connected to the wash tub 54 and 56 after extending through a gasket 53 interposed between the cabinet 62 and the tub 54. A nozzle 75 is provided at an end of the steam supply line 74 extending through the wash tub 54/56, in order to inject wash water into the wash tub 54/56 at high speed. A steam supply valve 73 is installed at the steam supply line 74. The steam supply valve 73 maintains the steam supply line 74 in an opened state while wash water is supplied into the wash tub 54/56. Although wash water is supplied into the wash tub 54/56, the steam supply valve 73 does not open the steam supply line 74 unless the internal pressure of the tank 76 reaches a predetermined level.

For easy repair and checking thereof, the tank 76 may be installed above the tub 54. Alternatively, the tank 76 may be installed beneath the tub 54 in the case in which there is a space for occupying the tank 76 beneath the tub 54. An insulating material 77 encloses the tank 76 to prevent loss of heat from the tank 76.

The heater 78 is of an electric type so that it generates heat in accordance with electric resistance thereof when electric power is applied thereto. The heater 78 is installed on an inner bottom portion of the tank 76. A temperature sensor 80 is also installed on the inner bottom portion of the tank 76

so that the heater 78 is controlled in accordance with an internal temperature of the tank 76 sensed by the temperature sensor 80. The heater 78 is provided with an automatic pressure switch 82 and an automatic temperature switch 84 respectively adapted to switch on or off operation of the heater 78 in accordance with the internal pressure and temperature of the tank 76. Accordingly, it is possible to prevent the heater 78 from generating overheat causing excessive generation of steam.

Meanwhile, a water level control means 90 is also provided in the interior of the tank 76 to control the water level of the tank 76, in order to prevent the water level of the tank 76 from exceeding a predetermined water level limit β even when wash water is continuously supplied into the tank 76.

The water level control means 90 comprises an air chamber 92 defined in the tank 76 above the water level limit β of the tank 76, and adapted to receive air pressurized as the water level of the tank 76 increases. The water level control means 90 also comprises an extension passage 94 connected, at one end thereof, to the steam supply line 74 while extending into the tank 76 such that the other end thereof is arranged at the water level limit β. When the water level of the tank 76 exceeds the water level limit β, the extension passage 94 drains an excessive amount of water supplied into the tank 76 in accordance with the pressure of air received in the air chamber 92, along with steam existing in the tank 76.

The water supply line 72 extends, at an end opposite to the water supply unit 60, through the top of the tank 76 into the tank 76 such that the end is arranged at the water level limit β of the tank 76. Accordingly, when the water level of the tank 76 exceeds the water level limit β, the end of the water supply line 72 is dipped in the water supplied into the tank 76, so that the air chamber 92 is maintained in a sealed state.

Meanwhile, the wash water received in the tank 76 may move from side to side during the supply of wash water into the tank 76 because the wash water supplied from the water supply line 72 is dropped into the tank 76. For this reason, even when the water level of the tank 76 exceeds the water level limit β, the end of the water supply line 72 may not be dipped in the water supplied into the tank 76. In order to prevent the wash water in the tank 76 from moving from side to side when the water level of the tank 76 reaches the water level limit β, a mesh 96 is installed in the tank 76 such that it is interposed between the water level limit β of the tank 76 and the inner top surface of the tank 76. The mesh 96 comes into contact with the surface of wash water in the tank 76 at a lower end thereof when the water level of the tank 76 reaches the water level limit β.

The mesh 96 has a plurality of cells respectively having rectangular or square cross-sections having the same size while

extending vertically from the water level limit β of the tank 76 to the inner top surface of the tank 76. With this structure, the mesh 96 partitions the air chamber 92 into a plurality of spaces.

At a central portion of a selected one of cell groups each consisting of four adjacent cells, the mesh 96 is provided with a steam hole 96′ connected to the steam supply line 74. The steam hole 96′ extends vertically from the water level limit β to the inner top surface of the tank 76 so that it forms the extension passage 94.

At a central portion of another selected cell group, the mesh 96 is also provided with a water hole 96″ connected to the water supply line 72. Similarly to the steam hole 96′, the water hole 96″ extends vertically from the water level limit β to the inner top surface of the tank 76, so that the water supply line 72 can be inserted into the tank 76 through the water hole 96″ at the top of the tank 76 to extend to the water level limit β of the tank 76.

The operation of the steam supplying apparatus having the above described configuration will now be described.

When wash water is supplied into the wash tub 54/56 by the water supply unit 60, the water supply line 72 is opened by the water supply valve 71. Accordingly, the wash water is supplied into the tank 76. The wash water supplied into the tank 76 is then heated by the heater 78, so that steam is

generated in the tank 76. When the internal pressure of the tank 76 exceeds a predetermined level due to the generated steam, the steam supply valve 73 is automatically opened, thereby opening the steam supply line 74. Thus, the steam from the tank 76 is fed into the wash tub 54/56 along the steam supply line 74.

In this case, the heater 78 is controlled by the temperature sensor 80, which senses the internal temperature of the tank 76, so that it does not generate overheat. Where the temperature sensor 80 operates abnormally, electric power supplied to the heater 78 may be automatically cut off by the automatic pressure switch 80 and automatic temperature switch 82. In this case, accordingly, the heater 78 does not generate overheat.

Meanwhile, air existing in the tank 76 is compressed as the water level of the tank 76 increases. Accordingly, although wash water is continuously supplied after the water level of the tank 76 reaches the water level limit β, the water level of the tank 76 can no longer increase due to the pressure of air applied to the surface of the wash water in the tank 76. In this case, the excessive amount of wash water is guided to the wash tub 54/56 through the extension passage 94 and steam supply line 74, so that it is used for washing of clothes.

When a predetermined time has elapsed after the opening of the water supply line 72, or when the supply of wash water

into the wash tub 54/56 is completed, the water supply valve 71 is closed, thereby closing the water supply line 72. Simultaneously, the operation of the heater 78 is stopped. In the stopped state of the heater 78, no steam is further generated in the tank 76, so that the internal pressure of the tank 76 decreases. As a result, the steam supply valve 73 is closed, thereby closing the steam supply line 74.

As apparent from the above description, in the steam supplying apparatus in the washing machine according to the present invention, high-temperature and high-pressure steam is supplied into the wash tub 54/56 at the top thereof during the supply of wash water into the wash tub 54/56. Accordingly, wetting of clothes by wash water is rapidly achieved at an initial water supply stage. Thus, there are advantages of reduced consumption of water and electric energy, and an improvement in sterilization performance and washing performance.

In the steam supplying apparatus according to the present invention, the air chamber 92 is provided in the tank 76 above the water level limit β. Also, the extension passage 94 is arranged between the water level limit β of the tank 76 and the steam supply line 74. Accordingly, it is possible to discharge an excessive amount of wash water from the tank by virtue of air pressure generated in the tank 76. Thus, it is possible to ensure a desired reliability of the steam supplying apparatus

in that the water level of the tank 76 can be controlled. Also, it is possible to achieve a simplification in structure and a reduction in manufacturing costs in that there is no requirement to install a separate water level sensor.

In the steam supplying apparatus according to the present invention, the water supply line 72 is inserted into the tank 76 through the top of the tank 76 such that the inserted end thereof is arranged at the water level limit β of the tank 76. Accordingly, when wash water is supplied into the tank 76 to reach the water level limit β, the air chamber 92 is reliably sealed to limit an increase in the water level of the tank 76.

In the steam supplying apparatus according to the present invention, the mesh 96 is installed in the tank 96 in order to prevent the wash water in the tank 76 from moving from side to side when the water level of the tank 76 during the supply of wash water into the tank 76. Accordingly, it is possible to stably control the water level of the tank 76.

Although the preferred embodiments of the invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.